

Risk Perception and Responses Among Private Forest Owners in Sweden

Louise Eriksson

Accepted: 8 April 2014 / Published online: 27 May 2014
© Steve Harrison, John Herbohn 2014

Abstract Forest risk management influences economic, recreation, and ecological values in the forest. To improve the understanding of forest risk management among private forest owners, in-depth interviews were carried out with 20 individual private forest owners in Sweden. Within an environmental stress framework, the forest owners' overall perception of a range of risks, or threats, that they perceive may damage their forest or harm them as a forest owner was uncovered. Overall, results revealed that the owners generally were not very concerned about forest risks. Nevertheless, natural hazards, such as storms and fires, and societal processes including political decisions concerning for example environmental regulations were mentioned among the most serious threats. Proactive as well as reactive strategies were used to deal with the risks—for example, insurance and forest management strategies. Because climate change is a potentially new risk that may affect forest owners, the owners' climate change perceptions were explored. The owners emphasised uncertainties and displayed a rather optimistic view of the impacts of climate change on their forests now and in the future. Two dimensions—risk tolerance and perceived control over risks—characterised forest owners' risk perception and responses. In addition, the susceptibility of the forest, previous risk experience, forest values, and the extent to which the owner is dependent on the forest—for example, economically—were relevant for understanding how risks are evaluated.

Keywords Forest risks · Climate change · Forest risk management · Environmental stress framework

L. Eriksson (✉)

Department of Geography and Economic History, Umeå University, 901 87 Umeå, Sweden
e-mail: louise.eriksson@geography.umu.se

Introduction

Forests provide ecosystem services and economic revenues as well as aesthetic experiences and recreational benefits. However, different natural hazards, such as fire, storm, insects, and climate change have the potential to severely damage the forest thereby leading to reduced revenues, loss of scenic beauty, and impacts on ecological values (Fuhrer et al. 2006; SOU 2007; Hanewinkel et al. 2008). In addition, the management of forests is influenced by societal processes, such as forest policy and tax regulations (Broadhead and Dubé 2003; Størdal et al. 2007). Individual actions including forest management and forest recreation activities, moreover may have detrimental impacts on the forests [Food and agricultural organization of the United Nations (FAO) 2010; Marzano and Dandy 2012]. Because natural hazards as well as societal processes and individual actions, can threaten forests, they can be considered potential forest risks. How risks are managed has important implications for the economic, social, and ecological values of the forest. In several countries, where the forest is an important natural resource, such as the United States, Finland, and Sweden, the number of private forest owners and, in particular, individual private forest owners (or family forest owners), is large [United States Department of Agriculture 2008; Finnish Ministry of Agriculture and Forestry 2011; Swedish Forest Agency (SFA) 2012]. Private forest owners' subjective views regarding risks determine what risks they attempt to manage and what strategies they use (e.g., Blennow et al. 2012). Hence, the risk perception and management by private forest owners is important for the health and quality of forests.

In previous studies, private forest owners' perceptions regarding single-risk topics, such as climate change, or sets of risks including natural, societal, and/or personal risks, have been examined (Blennow and Sallnäs 2002; Størdal et al. 2007; Blennow 2012). However, studies suggest that different risks are emphasised if people are asked to describe risks they themselves perceive to be important rather than sets of predefined risks (Zwick 2005). Even though private forest owners have been shown to emphasise a variety of different values in the forest including production, ecological, and recreation values (e.g., Ingemarson et al. 2006; Ní Dhúbháin et al. 2007), studies have focused mainly on the economic consequences of risks (cf. Blennow and Sallnäs 2002; Størdal et al. 2007). To understand the rationale behind risk management among private forest owners, there is a need to reveal how the owners themselves perceive forest risks without determining beforehand the risks or the most relevant impacts. The present study used qualitative data to examine private forest owners' risk perception and risk responses in Sweden.

Conceptual Framework

In this study, a wide range of forest risks are considered potential stressors to forest owners (see Fig. 1). Forest risks include different natural hazards, such as storms and insects, but also societal processes, including legislation which may restrict forest management, and taxes. Environmental stress research (e.g., Bell et al. 2001; Reser and Swim 2011) stipulates that stressors initiate an appraisal of the threat and

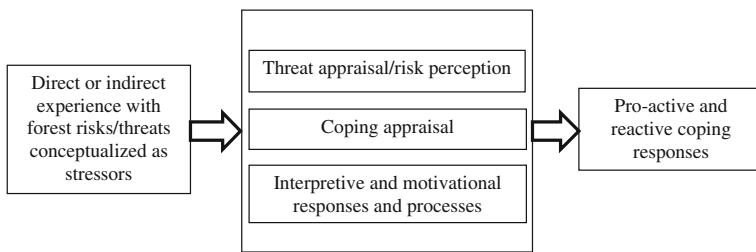
possible coping strategies. The experience with stressors can be direct through previous experience, or indirect, through others' experiences or media reports. Threat appraisals, also labelled risk perception, encompass evaluations of the threat including vulnerability to being affected and severity of the threat. Appraisals of coping strategies refer to evaluations of the extent to which a strategy is perceived to be effective (i.e., response efficacy), the extent to which the person has the ability to implement the strategy (i.e., self-efficacy), and the assumed cost. During threat and coping appraisals, interpretative processes including attributions of whether humans or natural processes are responsible for a threat and motivational processes eliciting responses are involved. The responses to threats can be implemented proactively when anticipating an event or reactively after an event. In addition, responses can be intra-individual, which may involve, for example, altering risk perceptions, or behavioural, including information seeking as well as implementing mitigation measures. Overall, both analytical (cognitive) processes that are mainly reason-oriented and experiential systems with emotional reactions, including anxiety, fear, and worry, are important for risk conceptualisations (cf. Slovic et al. 2004).

When attempting to understand risk perception and responses, it is furthermore important to consider various factors that may act as moderators during these processes, including characteristics of the event and the physical environment, characteristics of the individual, and characteristics of the social context (Reser and Swim 2011). With regard to the event and the physical environment, aspects such as the severity and intensity of the impact are likely to be important as well as the biophysical conditions in that setting. Individual differences concerning prior experience, values, and beliefs but also social factors including social constructions of risks and resources in the local community are relevant.

Forest Owners' Risk Perception and Responses

Previous studies have examined mainly cognitive, and not emotional, dimensions of forest owners' risk perception. For example, a study of forest owners in Sweden suggests that natural hazards including grazing by wild-life, storms, and insects are forest-related threats with the largest economic impact (Blennow and Sallnäs 2002). Societal risks such as economic risks (timber prices and consumer demand) and institutional risks (changes in forest related-taxes and forest protection) were considered to have significant economic consequences by forest owners in Norway (Størerdal et al. 2007). Notably, though, the extent to which these risks are considered serious threats to the owners and their forest more generally is not clear because these risks were evaluated only in terms of economic significance.

The proposed conceptual framework stipulates that forest owners' risk responses are related to their risk perception, and there is empirical evidence supporting this claim (Blennow and Sallnäs 2002; Størerdal et al. 2007). In relation to natural risks, a majority of the forest owners in a Swedish study took action against insects and grazing damage, and around one-third attempted to reduce the damage of root rot, storms, and snow (Blennow and Sallnäs 2002). In a Norwegian study, the use of advisors (e.g., from forest owners' associations), personal insurance, off-property work, and enterprise diversification of the property were perceived to be among the



MODERATORS: Characteristics of the event and the physical environment, characteristics of the individual, and characteristics of the social context.

Fig. 1 Overview of forest risk perception within an environmental stress framework (adapted from Reser and Swim 2011)

most important ways to deal with societal risks (Størdal et al. 2007). Nevertheless, studies indicate that in response to different hazards, land owners tend to make only minor adjustments that are easier and less costly (Brenkert-Smith et al. 2006; McGee et al. 2009).

Climate change has been described as a new risk, often perceived to be less urgent, associated with a large degree of uncertainty and of limited importance in everyday life (Weber 2006; Costa-Font et al. 2009; Poortinga et al. 2011; Nursey-Bray et al. 2012). The impacts of climate change nevertheless are becoming increasingly relevant to forest owners (SOU 2007). A study of forest owners in Sweden from the year 2004 (Blennow 2012) revealed that climate change was perceived to increase the risk somewhat of drought, storms, insects, and fungi. Furthermore, approximately 20 % of the owners stated that the climate change debate has had an impact on their forest management. Planting more mixed forests was the most frequently used strategy to deal with climate change, employed by more than half of the owners asserting that their management had been influenced by the debate. A more recent European study from 2010 revealed that a similar share of the owners in Sweden (20 %) had implemented strategies to deal with climate change, whereas the share in Germany and Portugal was around 50 % (Blennow et al. 2012). Notably, though, a recent study in the United Kingdom highlights the need to consider that climate change adaptive measures may be taken not as a result of climate change concerns alone (Lawrence and Marzano 2014).

Characteristics Relevant for Understanding Risk Perception and Responses

A series of characteristics are relevant to consider when examining individuals' risk perception and responses. By drawing on the proposed conceptual framework (see Fig. 1), characteristics related to (1) the event and the physical environment, (2) the individual, and (3) the social context are considered in relation to forest owners' risk perception below.

Perceptions of the event such as perceived impact, susceptibility to damage, and geographical location are likely to be related to risk perception and responses. For

example, homeowners' perceptions of the biophysical setting such as the surrounding forest have been found to influence risk perception and mitigation in relation to wildfires (Brenkert-Smith et al. 2006). Furthermore, studies suggest that forest owners in different geographical areas in Sweden differ in their risk assessment and responses, perhaps as a result of more extensive forest damage in certain areas or differences in silvicultural practices (Blennow and Sallnäs 2002; Blennow 2012).

Because not all individuals perceive risks the same way, individual characteristics are also relevant to consider. Direct experience of a threat is often described as an influential determinant of risk perception (Weinstein 1989), as demonstrated when Blennow and Sallnäs, (2002) found a link between prior experience, risk perception, and willingness to respond among forest owners in Sweden (see also Blennow et al. 2012). Notably, though, prior experience may lead to either higher or lower risk perception depending on the experience and implementation of coping strategies after the event (cf. Grothmann and Reusswig 2006; McGee et al. 2009). Furthermore, Slimak and Dietz (2006) showed that basic values and environmental beliefs influence environmental risk perception, and belief in climate change was important for adapting forest management to climate change among forest owners in different European countries (Blennow et al. 2012). This reasoning suggests that risk perceptions are part of an internal structure of related cognitions (see McFarlane and Boxall 2003) and the reasoning behind, for example, forest risk management may be further clarified by considering different forest cognitions such as forest values.

Individuals' risk perception emerges in a social context. Social and cultural norms as well as others' risk constructions are relevant for how people define and react to risks (e.g., Reser and Swim 2011). Since sub-groups in a society based on demographics, such as gender, age, and income, share certain collective experiences, their risk perception may be comparable in some regards. For example, women may perceive risks differently than men because of gendered structures in society (Gustafson 1998; Trumbo et al. 2011). In previous studies of forest owners, the focus has been mainly on how the economic role of the forest is important for risk perception and management. For example, one study suggests that owners who were more dependent on the forest were more concerned about economic factors (Lönnstedt and Svensson 2000). In relation to adapting forest management to climate change, Blennow et al. (2012) found that the most important socio-demographic variables were financial dependency on forestry and level of education, whereas age and gender, for example, were not significant.

The Present Study

Half of the productive forest in Sweden is privately owned by almost 330,000 individuals (SFA 2012), and even though forest management is regulated by the government, the owners are given a large degree of freedom (Bush 2010). The forest is dominated by coniferous trees, although a minor share, <20 %, is deciduous (SFA 2012). Forests in Sweden are damaged primarily by insects, fungi, grazing animals, storm winds, and heavy wet snow. Historically, storms have been responsible for the greatest economic damage in forestry (SOU 2007). For example, the south of Sweden (Götaland and Svealand) was affected by the hurricane 'Gudrun' in 2005

damaging 75 million square meters of forest, and 2 years later ‘Per’ damaged 12 million square meters of Norway Spruce (Witzell et al. 2009). In 2011, the northernmost parts (N. Norrland) were affected by downbursts with local forest damage (Fries et al. 2012). Although there is still a large degree of uncertainty, climate change is expected to have a significant impact on Swedish forestry in the future, leading to increased forest growth, but also increased risk of damage by fungi, insects, spring frost, and wind (SOU 2007).

In this study, qualitative data were used to analyse how private forest owners in Sweden conceptualise risks threatening their forests. The aim was to improve the understanding of how forest owners reason regarding risks and to explore characteristics related to risk perception and responses. The environmental stress framework (e.g., Reser and Swim 2011) guided the questions asked, although during the process of data collection and analyses, all themes relevant for understanding the owners’ perception of risks were sought. By considering forest risks as potential stressors, this framework reveals a broad spectrum of risks relevant to forest owners. Only after the owners’ own perceptions had been uncovered were a range of different risks asked about. More specifically, the following research questions were explored in the present study:

- How do forest owners describe forest risks (regarding e.g., probability, impact, emotions)?
- What strategies do forest owners use to deal with different risks?
- What characteristics are relevant for understanding forest owners’ risk perception and responses?
- What are the similarities and differences in perceptions regarding climate change and other forest risks?

Method

In-depth personal interviews were carried out with individual private forest owners in Sweden. Questions concerning the forest estate (e.g., size, tree composition), forest management strategies, the owner’s background, and forest values were asked in the first part of the interview. In the second part, subjective risk perception and risk-reducing strategies were explored starting with the question ‘What risks or threats do you perceive could damage your forest, or harm you as a forest owner?’ The mentioned risks were subsequently discussed concerning, for example, personal experience, why the risk was perceived to be serious (e.g., frequency, perceived impact), whether the owner worried about the risk, and how the risk was dealt with. Subsequently, the following risks were briefly discussed if they had not already been mentioned by the participant: economic risks including reduced timber prices, increased interest rates, and reduced demand among consumers; natural risks, such as storms, grazing damage, insects, and root rot; other people’s recreational activities; and societal laws and regulations, for example, changes in taxes or environmental regulations. In addition, climate change in relation to the forest was discussed starting with the question: ‘Climate change is a topic that is discussed a

lot these days. What is your opinion of climate change?" Themes covered in the interviews were, for example, impacts that have happened until today, expected impacts in the future, the time perspective regarding climate change, and the implementation of climate change adaptation strategies.

Because private forest owners in Western countries are heterogeneous when it comes to background, forest experience, and motives for owning forest (Ingemarson et al. 2006), a purposive sampling method was used to select forest owners for the interviews. The goal was not to achieve a representative sample of forest owners but to include a heterogeneous group of forest owners of different ages, both women and men, resident owners as well as non-resident owners, small- as well as large-scale forest owners, and forest owners living in different parts of Sweden (see Table 1). By varying the interviewees based on the owners' background characteristics, variation was also achieved with regard to type of forest they own (e.g., species composition), the location of the forest (e.g., close to the mountain, the sea), who is making plans for forest management (e.g., the owner, forestry agents), to what extent the forest is used for production, multiple uses, or investment, and whether the forest is located adjacent to recreational trails. The owners were identified through different channels including professional contacts and acquaintances, and all contacted owners agreed to participate. Guest et al. (2006) have suggested that twelve interviews are enough to discover relevant themes in qualitative data, although if the sample is heterogeneous, more interviews are needed. In this study, interviews with 20 forest owners were conducted. The obtained data were sufficient to describe how forest owners are generally thinking about forest risks.

The interviews were carried out in the town where the owners lived either in their own home or nearby in an office or in a quiet public place, such as a coffee shop. The interviews took between 30 min and 2 h and 45 min to complete, and all interviews were recorded. Data collection was carried out during the winter of 2011–2012 by the author. The interviews were analysed by listening to recordings and reading transcripts. The analysis was guided by the research questions and followed these steps: organizing the data into files, obtaining a general sense of what is important, coding the data, creating themes including several codes, representing the data in text and through illustration, and interpreting (cf. Creswell 2003).

Results and Discussion

Risk Perception

When the participants were asked to describe risks threatening their forest and them as forest owners, they mentioned from one up to eight different risks. Natural hazards but also societal processes were brought up. The owners were concerned mainly about risks such as those that could damage their forest severely resulting in a loss of economic and aesthetic value, or to risks such as stricter environmental regulations or compulsory acquisition of their forest which could result in them losing control over their forest. Hence, the multiple forest values emphasised by forest owners (cf. Ní Dhúbháin et al. 2007) were evident also in their perceptions of

Table 1 Overview of participants ($n = 20$) and comparison facts about private forest owners in Sweden based on SFA (2012) in brackets

Gender	12 men, 8 women (62 % men, 38 % female)
Age	37–78 years, M = 55 0–29 years: 0 (2 %) 30–49 years: 6 (25 %) 50–64 years: 10 (38 %) 65–74 years: 3 (21 %) Older than 75 years: 1 (12 %)
Owner category	Living on or nearby their forest: 8 (68 %) Non-residents: 10 (24 %) Part-time resident and part-time non-resident: 2 (–)
Size of forest estate	15–1,500 ha productive forest, including impediment: 16–2,200 ha 1–20 ha productive forest: 2 (47 %) 21–100 ha productive forest: 4 (38 %) 101–400 ha productive forest: 8 (13 %) More than 401 ha productive forest: 6 (2 %)
Years of owning forest	3–51 years (–)
Region	Götaland (southernmost) (Skåne, Blekinge, Småland): 6 (3,920 ha ^a) Svealand (southern) (Närke): 2 (2,709 ha ^a) South of Norrland (northern) (Hälsingland, Medelpad, Jämtland): 5 (2,442 ha ^a) North of Norrland (northernmost) (Norrbotten, Västerbotten, Lappland): 7 (2,587 ha ^a)

^a Hectares (ha) forest owned by private forest owners in different parts of Sweden

risks. Several owners stated that something they had cared for and managed would be destroyed.

Male, 67 years: It is bloody traumatic when it [a storm] comes because it destroys your concept. You have tried to think, ‘Here we should keep it like this,’ and so on. And everything has very long time cycles...all other operations are 50 years, here it is 60, 70, 80, and if we talk about oak, 120, 150 years. Everything is long-term.

Among the natural hazards perceived to threaten the forest, storms and fires were mentioned by a majority as the most serious risks, whereas insects and field mice were mentioned by a few owners. More than two-thirds of the interviewees described rather recent storm damage in their forest, from previous years as well as during the present winter. However, personal experience of fires was less common. Many highlighted not only the negative impacts storms have on the economy, but also the mental impact, mentioning that it is a struggle to take care of the trees damaged by wind. Moreover, among some of those who have been affected by storms, perceptions may have been tagged with affect since they said they worried a lot, thereby describing storms emotionally (cf. Slovic et al. 2004). A weighing of

frequency versus perceived impact was evident because there were owners who mentioned that although fires are less frequent, their impact can be huge and more serious than the impact of storms. In previous studies, forest owners in Sweden have considered storms to be serious (Blennow and Sallnäs 2002) whereas perceptions regarding wild fires have generally not been examined in this part of the world. From a societal point of view in Sweden, the damage from wind is generally considered more serious than the damage from fire (SOU 2007).

In addition, half of the interviewees also described societal processes as significant threats, such as political decisions including national and EU regulations and world crises such as bank crashes. Even though most of the owners stressed the need to consider nature values in the forest, too restrictive environmental regulations were considered to be a threat because they can restrict the owner from caring for the forest the way he or she wants to, can reduce the economic value of the forest, can hamper the owner's way of life, and can end up leaving the forest uncared for because there are insufficient funds to care for nature reserves. In addition, one owner close to a large recreational area mentioned compulsory acquisition of the forest by the municipality as a potential threat, and another owner was afraid that the mining industry could take control of his forest, thereby destroying his work. Only a few of the owners, however, described these restrictions in emotional terms. In addition, fluctuations in forestry—for example, what is right today was forbidden some decades ago—were criticised and owners highlighted the need for regulations, including environmental regulations and taxes, to be stable over time. Although the emphasis given to institutional risks, including forest protection, is in line with results by Stórdal et al. (2007), economic risks such as reduced demand and changes in forest-related taxes were described as serious risks by only a minority of the owners in the present study.

Risk Tolerance

Even though the owners described how one or several forest risks threaten to damage their forest, they generally were not very concerned about risks. Among those who mentioned only one risk as serious, they said that they were generally not thinking about risks, and even the owners describing many risks as potentially harmful were concerned about only a few of them. Hence, a distinction can be made between being aware of a risk and being concerned about a risk.

Author: Is that something you are concerned about [i.e., that his forest will become a nature reserve]?

Male, 64 years: I think about it; I don't worry about it but I think about it: what decisions will come? How far will they take it?

—
Male, 51 years: Wind, I don't perceive it as a huge risk, but of course it exists.

A need to accept or tolerate risks was nevertheless conveyed in the interviews because it is impossible to reduce all risks, there is no point in worrying, and other

interests need to be considered, for example, that game have the right to live in the forest regardless of grazing damage. Related to tolerance was a positive view of their forest.

Male, 37 years: It is a problem when they occur, storms and fires and all those things, but shit happens, it is part of the process.

Female, 37 years: What risks are there? Well, there are both physical, affecting the forest, and a lot of world risks... Anyhow, I have a positive outlook on owning forest; it is not like I become sad and think that this will never work and horrible things will happen.

The interviews thus suggest that forest owners' risk perception may be viewed on a dimension labelled risk tolerance. This dimension reflects variations in the need to accept or tolerate a certain risk ranging from high tolerance accompanied by positive perceptions and low concern, to low risk tolerance dominated by pessimism and high concern. In previous research, the term risk tolerance has been used to describe active risk taking (Pauely et al. 2008; also cf. Andersson 2012). However, the owners in this study express rather a passive tolerance of risks. Notably, though, tolerating a risk does not necessarily correspond to being unaware of the risk. Whereas those demonstrating a low risk tolerance always expressed concern, owners displaying a high risk tolerance sometimes were unaware of the risk (or distanced from it), and sometimes were aware but not concerned. Awareness involved a cognitively based description of the risk, for example, regarding impacts, whereas concern was described using cognitive, but also emotional terms such as worrying about a risk. A distinction between awareness and concern has been noted in previous studies of risks (Olofsson and Öhman 2007; McGee et al. 2009). Studies have found moreover that public acceptance is higher if the risk is associated with more benefits (Bronfman and Cifuentes 2003). Although the risks described by the owners in this study can hardly be considered beneficial to the owner, owning forest can provide enough benefits to make it worthwhile to tolerate some risks.

Risk Responses

To deal with risks, the owners used different proactive and reactive strategies. All but one of the interviewees had some kind of insurance to protect against, for example storms, fires, and/or grazing damage by wildlife. However, having insurance did not seem to reduce the level of concern for risks and the satisfaction with their insurance was generally limited.

Male, 45 years: You have insurances but you know they don't provide good coverage, just forget it.

The large majority used forest management strategies to reduce the risk of damage by hazards; for example, they avoided thinning too hard to reduce the risk of wind damage and they planted the right trees on the right soil. In addition, the need to control game by hunting to reduce the risk of browsing damage was highlighted by the owners. The forest owners, mainly resident owners, mentioned

that they handled risks by checking on the forest to detect problems of, for example, storm damage, insects, or fires, and one of the non-resident owners had someone else check on the forest regularly. The majority of the owners mentioned that their risk management involved others, for example, communication with neighbouring forest owners or seeking advice from consultants at owner organizations and/or the Swedish Forest Agency. Although other people's recreational activities were generally not considered a threat, three owners had put up gates to prevent people from dumping garbage in their forest. To reduce economic risks, owners with larger estates mentioned the need to sell regularly to spread risks and to deal with reduced consumer demand through, for example, finding new ways to use the forest. The owners furthermore highlighted a need to follow what is happening and to be prepared to deal with societal processes threatening their forest, including changes in taxes or regulations.

Perceived Control

Whereas some owners emphasised solutions, others focused more on the difficulties associated with dealing with risks, thereby reflecting various levels of perceived control (cf. Slovic 1987).

Female, 50 years: I'm not really a worried person, so that is why I don't think it's a large problem, but I feel that it is about 'nipping it in the bud' and being prepared and then the biggest disaster becomes more comprehensible. But also that you must speculate using different scenarios and think about what you will do and how do you seek help. I think that is important. Instead of wasting energy on being worried, it is better to think about how I solve it afterwards.

Author: Is there something you can do to handle storms?

Male, 65 years: Yes, I have cleared around the house. I think it is very difficult because there will be a lot of damage if you have a cut at the edges. But I don't see that I can do much at all.

The owners' perceptions regarding risk responses thus may be viewed on a second dimension, perceived control. This dimension reflects the extent to which the owners perceived they could do something to handle the risks, ranging from low control associated with a passive response, to high control linked to a more active response. Whereas those displaying low perceived control could vary in awareness and concern, high perceived control presupposed a certain level of awareness of the risk. Moreover, by having a successful strategy implemented, concern could be reduced. The importance of perceived control for behaviours in general, and for risk management in particular, frequently has been highlighted and tends to refer to issues such as self-efficacy and response-efficacy (Ajzen 1991; Slovic 1987; Reser and Swim 2011).

Climate Change Perceptions and Responses

In line with previous studies of climate change perceptions (Poortinga et al. 2011; Nursey-Bray et al. 2012), the interviewees expressed uncertainty when talking about

climate change regarding potential impacts and when changes may occur. Opinions varied from stressing natural variations in temperature linked with a scepticism concerning climate change to being convinced that the climate is changing now. The largest group, about half of the owners, talked about natural variation now, but that the climate will or may change later on. Among those who believed that climate change is happening now, both negative impacts, including more storms and insects, and positive impacts, such as better growth and new tree species were highlighted. Comparable to other forest risks, risk tolerance and positive expectations were also evident when it comes to climate change.

Male, 46 years: It is like the weather in general, and nature—it is nothing you can control, it is just to accept.

Male, 58 years: I'm quite optimistic; I believe in the future, that this will for sure be good.

Consistent with studies revealing that individuals perceive climate change to be a greater risk to the environment in general than to them personally (Costa-Font et al. 2009), owners focusing on the positive impacts of climate change on their forest highlighted negative impacts elsewhere in the world. Almost half of the interviewees already had noticed impacts on their forest—for example, more storms, changes in soil conditions, and growth of new species. In addition, the owners mentioned that trees have started to grow faster, either describing them as stressed trees or highlighting the improved profit associated with faster growth. Others said that it is still too early to see any effects, that they have owned the forest only for a short time or that the owner is not old enough to see any effects. Even among those describing climate change as a concern in the future, several said they were not worried, for example, because they did not think about climate change in relation to their forest or believed that nature would adjust. Notably, only two of the interviewees mentioned climate change among the most serious risks, and these owners were still not very concerned.

The majority of the owners did not consider climate change when planning for their forest. For some, this response could be traced to their view that climate change is not occurring right now, although uncertainties regarding risk management also were expressed (cf. Nursey-Bray et al. 2012).

Author: Are you doing anything today to handle climate change? Is it something you consider when you think about and plan for your forest?

Woman, 60 years: No, no. What is there to do? I have difficulties seeing what I could do.

However, several of the owners said that they will consider climate change in the future, for example, by clearing dikes when planting or through other management strategies. One-fourth of the owners strived towards a varied forest because it is beautiful or to make the forest stronger and healthier, although not specifically to deal with climate change. Only two owners said they implemented strategies to adapt to climate change, although not exclusively for this purpose. For example, one owner checked on the forest regularly for insects, dikes, and flooding, and the other

used continuous cover forestry and strived towards more variation and more deciduous trees when planting.

To understand the results presented by Blennow (2012) (see also Blennow et al. 2012) where only a minority considered climate change in their forest management right now, it is useful to highlight how the owners in the present study focused on the uncertainties, the long-term perspective, and displayed a rather optimistic view of climate change impacts on their forest, including increased growth. Notably, though, results suggest that many owners are aware of this issue and they state that more strategies likely will be employed later on.

The Relevance of the Risk and the Forest, the Individual, and the Social Context

For both natural hazards and societal processes, the extent to which the forest is perceived to be susceptible to the risk, related to the biophysical conditions in the forest, was clearly reflected in the owners' risk perception. Geographic differences were illustrated, for instance, when field mice were highlighted as a serious risk among only two owners in one part of the country (i.e., S. Norrland). In addition, the perceived susceptibility of the specific forest played a significant role for risk perception, depending on wind exposure, nature values, and forest management strategies, and the like. Low susceptibility was commonly referred to as a reason for not being concerned.

Several individual characteristics were relevant for risk perception and responses. For example, personal experience of a risk seemed to have increased salience because owners with experience often mentioned this risk early in the interview. However, owners with very little experience of, for example, storms or fires also perceived these risks to be serious. Having already implemented risk-reducing strategies generally reduced concern among owners; nevertheless if the strategies were perceived to be insufficient, the owner still worried about the risk (cf. Weinstein 1989). The present study showed further that in line with Slimak and Dietz (2006), related cognitions or beliefs are important for risk perception, particularly in relation to societal risks, but also to climate change. Forest owners emphasising production values in the forest used economic terms to describe risks explicitly or described threats to production values, such as environmental regulations, as serious. Although the owners referred to specific forest knowledge and personal experiences when describing climate change, more general knowledge and beliefs related to climate change were also prevalent (cf. Stedman 2004). Moreover, references to other beliefs—for example, political opinions—were evident when the owners described more general risks such as the negative impact on rural areas when outsiders buy forest and the number of resident owners is reduced.

Characteristics with social connotations were reflected both in perceptions of natural hazards and societal risks. For example, not being dependent on the forest for their living made the impacts of risks less important, according to some owners, and they were less aware or less worried about risks. One non-resident owner stated furthermore that other sources of income, but also having a life situated elsewhere, resulted in being less concerned about forest risks. However, the same owner

considered living far away to be a risk because it made it impossible to check on the forest. Being a small private forest owner was also described as a serious risk by one owner because of the possibility of being cheated by large companies, thereby highlighting power differences between different actors in the forestry sector. Age may furthermore be relevant for forest risk perception because the two oldest participants (69 years and older) both highlighted that their age made them less worried about some risks.

Overall, perceptions regarding the risk and the forest, the individual, and the social context were relevant for understanding forest owners' risk perception and responses and can be linked to the two proposed dimensions, risk tolerance and perceived control. For example, if the forest is perceived to be less susceptible to a risk, or if the owner is not dependent on the forest for his or her living, risk tolerance is likely to increase and concern to decrease. In addition, hazard experiences are likely to influence perceived control. Notably, though, because only a small sample of forest owners was examined in the present study, quantitative studies are needed to determine the importance of various characteristics. For example, no gender differences were evident in the present study, although differences may be revealed in a larger sample of forest owners. It is furthermore necessary to direct more attention to social characteristics in future studies, such as how others, part of the owners' network, influence forest risk perception and responses (cf. Brenkert-Smith et al. 2006).

Conclusions

The present study explored how risks are conceptualised when something valued—that is, the forest—is threatened. The in-depth interviews suggest that two dimensions, labelled *risk tolerance* and *perceived control*, are important for understanding forest owners' risk perception and responses. There is furthermore a need to differentiate between risk awareness and concern. The two dimensions are depicted as orthogonal because the owners' perception of different risks fit in different quadrants. Various characteristics related to the risk and the forest, the individual, and the social context moreover were found to be relevant. An illustration of the two dimensions is shown in Fig. 2.

By considering the two dimensions, risk tolerance and perceived control, it is possible to classify forest owners' risk perception and responses in relation to specific risks. In general, the owners described a few risks as serious, associated with a low risk tolerance. They were generally concerned about these risks and 'no way out' perceptions dominated when no strategies to deal with the risk were perceived to be available. In contrast, perceptions of insufficiency were evident if they had attempted to deal with the risk although without success (i.e., 'concern driven—insufficient'). However, there were owners displaying high risk tolerance of all risks, varying from 'withdrawn' to 'ready' to 'awareness driven', depending on the level of perceived control. In relation to a few risks that were considered serious, strategies had been implemented and the risk was no longer a concern (i.e., 'concern driven—attained'). Climate change was generally tolerated and considered

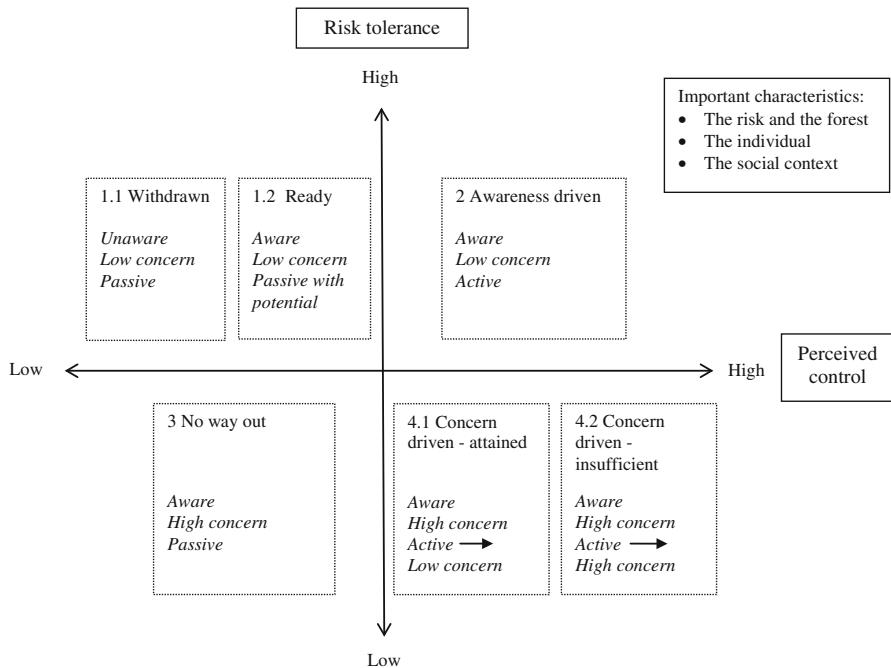


Fig. 2 Two dimensions, risk tolerance and perceived control, describing risk perception and responses among private forest owners

a lesser concern even though several acknowledged that it is a risk or a potential risk in the future (cf. Nursey-Bray et al. 2012). A few can be described as ‘withdrawn’ when it comes to climate change, others as ‘ready’ or ‘awareness driven’.

The risk management of private forest owners is not necessarily consistent with the recommendations made by, for example authorities or forest researchers, but is determined by the owners’ subjective perception of risks. Whereas previous studies have been limited mainly to examining specific risks, exploring a limited set of risks (Blennow and Sallnäs 2002; Størdal et al. 2007; Blennow 2012), the present study provides a more comprehensive understanding of *how* private forest owners perceive old as well as new risks. In addition, the study was not limited to risk cognitions, but also considers emotions relevant to risk perception. Even though the present study was conducted in Sweden, the more general dimensions of risk tolerance and perceived control furthermore may be relevant to private forest owners in other countries.

Certain limitations should be considered when interpreting the results. Most notably, the interviewees cannot be considered representative of private forest owners in Sweden. However, because a heterogeneous group of forest owners participated in the study, a diversity of perspectives on risks was illustrated. It is furthermore noteworthy that the risk of storms may have been particularly salient to the owners because several storms occurred during the study. Nevertheless, storms

have been responsible for the greatest economic damage in forestry in Sweden (SOU 2007), indicating that the emphasis given to storms is reasonable. To what extent awareness of risks can initiate a response is an important topic for future studies. Although Olofsson and Öhman (2007) found no evidence that awareness of new risks initiates a behavioural response among people from the public, the present study suggests that being aware, but not concerned, may still initiate action if there are strategies to deal with the risk. Perhaps people in general display a superficial awareness of new risks, whereas the owners' belief that their forest is important resulted in a more profound awareness of forest risks, both old and new.

Because forest owners in Sweden are autonomous to a large degree (Bush 2010), communication is an important instrument in the risk management of authorities. Results from the present study of subjective risk perception among private forest owners can be used to improve risk communication and help with the adjustment of messages to better suit the target group. To make the owners more prepared to deal with risks, authorities need to emphasise forest risks more and to recommend suitable risk management strategies when being in contact with forest owners. For example, owners being unaware of (or distant from) a risk may resist any information concerning that risk. Since most owners are concerned, or at least aware, of some risks it may be fruitful to provide information on different forest risks simultaneously in order to capture the attention of a larger group of owners. Because uncertainty dominates climate change perceptions, recommendations concerning adaptation may need to be justified by stressing the benefits to the forest in general, rather than labelling them only as climate change adaptation strategies. Moreover, the issue of trust in authorities is important in risk management (e.g., Earle 2004). However, since lower acceptance of environmental hazards has been found to be related to lower trust in responsible authorities (Bronfman et al. 2008), forest owners may distrust authorities' recommendations when it comes to risks they are specifically concerned about. To prepare for effective risk communication, the responsible authorities thus need to strive continuously for good relations with private forest owners (cf. Hujala and Tikkannen 2008).

Acknowledgments This research was funded by Future Forests, a multidisciplinary research programme, and its sponsors: The Strategic Foundation for Environmental Research (*Mistra*), The Swedish University of Agricultural Sciences (SLU), Umeå University, The Forestry Research Institute of Sweden (*Skogforsk*) and the forestry industry in Sweden. The author would like to thank sincerely the participating forest owners and two anonymous reviewers for their helpful comments.

References

Ajzen I (1991) The theory of planned behavior. *Organ Behav Hum Decis* 50:179–211
Andersson M (2012) Assessing non-industrial private forest owners' attitudes to risk: do owner and property characteristics matter? *J For Econ* 18:3–13
Bell PA, Greene TC, Fischer JD, Baum A (2001) Environmental psychology, 5th edn. Harcourt College, Fort Worth
Blennow K (2012) Adaptation of forest management to climate change among private individual forest owners in Sweden. *For Policy Econ* 24:41–47
Blennow K, Sallnäs O (2002) Risk perception among non-industrial private forest owners. *Scand J For Res* 17:472–479

Blennow K, Persson J, Tomé M, Hanewinkel M (2012) Climate change: believing and seeing implies adapting. *PLoS One* 7:1–7

Brenkert-Smith H, Champ PA, Flores N (2006) Insights into wildfire mitigation decisions among wildland–urban interface residents. *Soc Nat Resour* 19:759–768

Broadhead J, Dubé YC (2003) Cross-sectoral policy impacts in forestry. XII World Forestry Congress, Québec City, Canada. <http://www.fao.org/docrep/article/wfc/xii/0179-c1.htm>. Accessed 13 Nov 2013

Bronfman NC, Cifuentes LA (2003) Risk perception in a developing country: the case of Chile. *Risk Anal* 12:411–416

Bronfman NC, Vázquez EL, Gutiérrez VV, Cifuentes LA (2008) Trust, acceptance and knowledge of technological and environmental hazards in Chile. *J Risk Res* 11:755–773

Bush T (2010) Biodiversity and sectorial responsibility in the development of Swedish Forestry Policy, 1988–1993. *Scand J Hist* 35:471–498

Costa-Font J, Mossialos E, Rudisill C (2009) Optimism and the perceptions of new risks. *J Risk Res* 12:27–41

Creswell JW (2003) Research design: qualitative, quantitative and mixed methods approaches, 2nd edn. Sage, Thousand Oaks

Earle TC (2004) Thinking aloud about trust: a protocol analysis of trust in risk management. *Risk Anal* 24:169–183

Finnish Ministry of Agriculture and Forestry (2011) Finland's national forest programme 2015. http://www.mmm.fi/attachments/metsat/kmo/5xmlHiuZo/NFP_2015_Turning_the_Finnish_forest_sector_into.pdf. Accessed 13 Nov 2013

Food and Agricultural Organization of the United Nations (FAO) (2010) Global Forest Resources Assessment 2010. FAO Forestry Paper 163. Rome

Fries C, Lindqvist A, Malmberg PA (2012) Skogsskador i region Norr 2011. [Forest damage in the northern region 2011] PM Skogsskaderapport. Swedish Forest Agency (in Swedish). <http://www.skogsstyrelsen.se/Global/myndigheten/Skog%20och%20miljo/Skade%C3%B6vervakning/Skogsskador%20i%20AC%20och%20BD%2011%C3%A4n%202011%20-%20slutversion%2025%20jan%202012.pdf>. Accessed 13 Nov 2013

Führer J, Beniston M, Fischlin A, Frei Ch, Goyette S, Jasper K et al (2006) Climate risks and their impact on agriculture and forests in Switzerland. *Clim Change* 79:79–102

Grothmann T, Reusswig F (2006) People at risk of flooding. Why some residents take precautionary action while others do not. *Nat Hazards* 38:101–120

Guest G, Bunce A, Johnson L (2006) How many interviews are enough? An experiment with data saturation and variability. *Field Methods* 18:59–82

Gustafson PE (1998) Gender differences in risk perception: theoretical and methodological perspectives. *Risk Anal* 18:805–811

Hanewinkel M, Breidenbach J, Neeff T, Kublin E (2008) Seventy-seven years of natural disturbances in a mountain forest area—the influence of storm, snow, and insect damage analysed with a long-term time series. *Can J For Res* 38:2249–2261

Hujala T, Tikkanen J (2008) Boosters of and barriers to smooth communication in family forest owners' decision making. *Scand J For Res* 23:466–477

Ingemarsson F, Lindhagen A, Eriksson L (2006) A typology of small-scale private forest owners in Sweden. *Scand J For Res* 21:249–259

Lawrence A, Marzano M (2014) Is the private forest sector adapting to climate change? A study of forest managers in north Wales. *Ann For Sci* 71:291–300

Lönnstedt L, Svensson J (2000) Return and risk in timberland and other investment alternatives of NIPF owners. *Scand J For Res* 15:661–669

Marzano X, Dandy X (2012) Recreational use of forests and disturbance of wildlife. A literature review. Forestry Commission, Edinburgh. [http://www.forestry.gov.uk/pdf/FCRP020.pdf/\\$file/FCRP020.pdf](http://www.forestry.gov.uk/pdf/FCRP020.pdf/$file/FCRP020.pdf). Accessed 13 Nov 2013

McFarlane BL, Boxall PC (2003) The role of social psychological and social structural variables in environmental activism: an example of the forest sector. *J Environ Psychol* 23:79–87

McGee TK, McFarlane BL, Varghese J (2009) An examination of the influence of hazard experience on wildfire risk perceptions and adoption of mitigation measures. *Soc Nat Resour* 22:308–323

Ní Dhubháin AN, Cobanova R, Karppinen H, Mizaraite D, Ritter E, Slee B et al (2007) The values and objectives of private forest owners and their influence on forestry behavior: the implication for entrepreneurship. *Small-scale For* 6:347–357

Nursey-Bray M, Pecl GT, Frusher S, Gardner C, Haward M, Hobday AJ et al (2012) Communicating climate change: climate change risk perceptions and rock lobster fishers, Tasmania. *Mar Policy* 36:753–759

Olofsson A, Öhman S (2007) Views of risks in Sweden: global fatalism and local control—an empirical investigation of Ulrich Beck's theory of new risks. *J Risk Res* 10:177–196

Pauely K, O'Hare D, Wiggins M (2008) Risk tolerance and pilot involvement in hazardous events and flight into adverse weather. *J Safety Res* 39:403–411

Poortinga W, Spence A, Whitmarsh L, Capstick S, Pidgeon NF (2011) Uncertain climate: an investigation into public scepticism about anthropogenic climate change. *Glob Environ Change* 21:1015–1024

Reser JP, Swim JK (2011) Adapting to and coping with the threat and impacts of climate change. *Am Psychol* 66:277–289

Slimak MW, Dietz T (2006) Personal values, beliefs, and ecological risk perception. *Risk Anal* 26:1689–1705

Slovic P (1987) Perception of risk. *Science* 236:280–285

Slovic P, Finucane ML, Peters E, MacGregor DG (2004) Risk as analysis and risk as feelings: some thoughts about affect, reason, risk, and rationality. *Risk Anal* 24:311–322

SOU (2007) Sweden facing climate change—threats and opportunities. Final report from the Swedish Commission on climate and vulnerability. Swedish Government Official Reports, SOU 2007:60. Stockholm

Stedman RC (2004) Risk and climate change: perceptions of key policy actors in Canada. *Risk Anal* 24:1395–1406

Størstad S, Lien G, Hardaker JB (2007) Perceived risk sources and strategies to cope with risk among forest owners with and without off-property work in eastern Norway. *Scand J For Res* 22:443–453

Swedish Forest Agency (SFA) (2012) Swedish Statistical Yearbook of Forestry. [http://www.skogsstyrelsen.se/Global/myndigheten/Statistik/Skogsstatistik%20%C3%A5rsbok/03.%202010-2012/Skogsstatistik%20%C3%A5rsbok%202012%20\(hela\).pdf](http://www.skogsstyrelsen.se/Global/myndigheten/Statistik/Skogsstatistik%20%C3%A5rsbok/03.%202010-2012/Skogsstatistik%20%C3%A5rsbok%202012%20(hela).pdf). Accessed 13 Nov 2013

Trumbo C, Lueck M, Marlatt H, Peek L (2011) The effect of proximity to hurricanes Katrina and Rita on subsequent hurricane outlook and optimistic bias. *Risk Anal* 31:1907–1918

United States Department of Agriculture (2008) Who owns America's forests? Forest ownership patterns and family forest highlights from the National Woodland owner survey. Northern Research Station, NRS-INF-06-08

Weber EU (2006) Experience-based and description-based perceptions of long-term risk: why global warming does not scare us (yet). *Clim Change* 77:103–120

Weinstein ND (1989) Effects of personal experience on self-protective behaviour. *Psychol Bull* 105:31–50

Witzell J, Barklund P, Bergquist J, Berglund M, Bernhold A, Blennow K et al (2009) Skador på skog. [Damage to forests] Skogsskotselserien. Swedish Forest Agency (in Swedish). <http://www.skogsstyrelsen.se/Global/PUBLIKATIONER/Skogsskotselserien/PDF/12-Skador%20pa%20skog.pdf>. Accessed 13 Nov 2013

Zwick MM (2005) Risk as perceived by the German public: pervasive risks and “switching” risks. *J Risk Res* 8:481–498